

What is claimed is:

1. An ultraviolet laser-generating device, comprising:

a laser ray source for irradiating and emitting a basic wave of laser ray therefrom;

5 a wavelength converter device for receiving the basic wave of laser ray emitted from said laser ray source and for converting it into an ultraviolet laser ray composed of a multiplied high harmonic light of the basic wave of laser ray; and

10 a container having an inlet window, upon which the basic wave of laser ray emitted from said laser ray source is incident upon, and an outlet window for emitting the ultraviolet laser ray composed of the multiplied high harmonic light of the basic wave of laser ray, and installing said wavelength converter device therein, wherein said container is filled up with an inert gas
15 therein.

2. An ultraviolet laser-generating device, as defined in the claim 1, wherein said wavelength converter device comprises:

an optic resonator, being located within said container and constructed with plural optical members, for resonating the
20 basic wave of laser ray; and

a non-linear optical element, being located within said container and constructed with plural optical members, for generating the ultraviolet laser ray composed of the multiplied high harmonic light obtained from the basic wave of laser ray.

25 3. An ultraviolet laser-generating device, as defined in the claim 1, wherein said container is hermetically sealed, and is further provided with means for discharging residual gas within said container and means for supplying the inert gas into said container.

4. An ultraviolet laser-generating device, as defined in the claim 1, wherein on a part of inner wall of said container is provided trap means for fixing contaminants floating within said container thereon.

5 5. An ultraviolet laser-generating device, as defined in the claim 1, wherein said container, in which said wavelength converter device is installed, is constructed in dual or triple construction, for defining an aperture between them, to be filled up with the inert gas therein.

10 6. An ultraviolet laser-generating device, as defined in the claim 1, further comprising an optical detection means for detecting contamination condition within said container.

15 7. An ultraviolet laser-generating device, as defined in the claim 6, wherein said optical detection means comprises plural number of photoelectric conversion elements positioned within said container.

20 8. An ultraviolet laser-generating device, as defined in the claim 6, further comprising a detection means for detecting an output intensity of the ultraviolet laser ray emitted from said wavelength converter device.

9. An ultraviolet laser-generating device, as defined in the claim 1, wherein said laser ray source comprises a solid-state laser-generating device.

25 10. An ultraviolet laser-generating device, as defined in the claim 9, wherein said laser ray source comprises a Nd:YAG laser and a wavelength converter for converting the laser ray from said Nd:YAG laser into a laser ray having 1/2 wavelength thereof.

30 11. A defect inspection apparatus for detecting defects in microscopic patterns formed on a test object, with using an ultraviolet laser ray, comprising:

an ultraviolet laser-generating device, as defined in the

claim 1;

an illumination optical system for irradiating the ultraviolet laser ray emitted from said ultraviolet laser-generating device upon the test object;

5 an optical system for forming an optical image obtained from said test object, being illuminated by said illumination optical system;

10 a photoelectric converter for converting the optical image, which is formed by said optical system, into a signal upon receipt thereof; and

a defect detection circuit for detecting the defect on said test object upon basis of the signal obtained from said photoelectric converter.

12. A defect inspection apparatus for detecting defects in microscopic patterns formed on a test object, with using an ultraviolet laser ray, comprising:

a plurality of ultraviolet laser-generating devices, being aligned so that the ultraviolet laser rays emitted are on a same axis;

20 an illumination optical system for irradiating the ultraviolet laser ray(s) emitted from at least one or more of said ultraviolet laser-generating devices upon the test object;

25 an optical system for forming an optical image obtained from said test object, being illuminated by said illumination optical system;

a photoelectric converter for converting the optical image, which is formed by said optical system, into a signal upon receipt thereof; and

a defect detection circuit for detecting the defect on said

test object upon basis of the signal obtained from said photoelectric converter.

13. A defect inspection apparatus, as defined in the claim 12, wherein at least one of said plurality of ultraviolet laser-generating devices is for a spare.

14. A defect inspection apparatus, as defined in the claim 12, wherein said illumination optical system comprises an optical system for combining the ultraviolet laser rays emitted from each of said plurality of ultraviolet laser-generating devices, to illuminate the test object therewith.

15. A defect inspection apparatus, as defined in the claim 12, wherein each of said ultraviolet laser-generating devices, comprises:

a laser ray source for irradiating and emitting a basic wave of laser ray therefrom;

a wavelength converter device for receiving the basic wave of laser ray emitted from said laser ray source and for converting it into an ultraviolet laser ray composed of a multiplied high harmonic light of the basic wave of laser ray; and

a container having an inlet window, upon which the basic wave of laser ray emitted from said laser ray source is incident upon, and an outlet window for emitting the ultraviolet laser ray composed of the multiplied high harmonic light of the basic wave of laser ray, and installing said wavelength converter device therein, wherein said container is filled up with an inert gas therein.

16. A defect inspection apparatus, as defined in the claim 15, wherein said wavelength converter device of said wavelength converter device, comprises:

an optic resonator, being located within said container and constructed with plural optical members, for resonating the

basic wave of laser ray; and

a non-linear optical element, being located within said container and constructed with plural optical members, for generating the ultraviolet laser ray composed of the multiplied
5 high harmonic light obtained from the basic wave of laser ray.

17. A defect inspection apparatus, as defined in the claim 12, wherein said illumination optical system comprises a coherence reduction optical system.

18. A method for inspecting defects in microscopic patterns
10 formed on a test object, with using an ultraviolet laser ray, comprising the following steps:

generating an ultraviolet laser ray by the ultraviolet laser-generating device, as defined in the claim 1;

illuminating the test object with using the ultraviolet
15 laser ray generated by said generating step;

forming an optical image of the test object from light obtained in said illumination step of the test object;

converting the optical image obtained in said forming step into a signal upon receipt thereof; and

20 detecting the defect on said test object upon basis of the signal obtained in said converting step.

19. A method for inspecting defects in microscopic patterns formed on a test object, with using an ultraviolet laser ray, comprising the following steps:

25 generating a plurality of ultraviolet laser rays, so as to be aligned with on a same axis, as one ultraviolet laser ray;

illuminating the test object with using the one ultraviolet laser ray aligned in ed said generating step;

forming an optical image of the test object from light obtained in said illumination step of the test object;

converting the optical image obtained in said forming step into a signal upon receipt thereof; and

5 detecting the defect on said test object upon basis of the signal obtained in said converting step.

20. A method for maintaining the ultraviolet laser-generating apparatus as defined in the claim 8, comprising the following steps:

10 monitoring an output of the output intensity detecting means for comparing it to a certain value;

obtaining an output of said optical detection means for detecting contamination condition within said container of the ultraviolet laser-generating apparatus; and

15 determining maintenance of the ultraviolet laser-generating apparatus, upon basis of an output obtained by said obtaining step.